

AMENDED CLAIMS

1.(amended) A gate turn-off thyristor of a wide-gap semiconductor, comprising:

5 a first emitter layer of either one of n-type and p-type conductive types having a first electrode on its one surface;

a first base layer of a conductive type different from that of the first emitter layer provided on the other surface of the first emitter layer;

10 a second base layer of a conductive type identical to that of the first emitter layer provided on the first base layer;

15 a mesa-type second emitter layer of a conductive type different from that of the first emitter layer provided on the second base layer;

a second electrode provided on the mesa-type second emitter layer;

20 a low-resistance gate region provided in the second base layer below a bottom surface of a mesa that surrounds the mesa-type second emitter layer and having a conductive type identical to that of the second base layer and an impurity concentration higher than that of the second base layer; and

25 a third electrode put in contact with the low-resistance gate region via a gate contact region.

2. The gate turn-off thyristor of a wide-gap semiconductor as claimed in claim 1, wherein

5 a low-resistance region is provided by making the low-resistance gate region have an impurity concentration in the neighborhood of the junction thereof with the third electrode higher than an impurity concentration of the other portion of the low-resistance gate region.

10 3. The gate turn-off thyristor of a wide-gap semiconductor as claimed in claim 1, wherein

the low-resistance gate region is provided in the second base layer in the neighborhood of the junction between the second emitter layer and the second base layer.

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4. The gate turn-off thyristor of a wide-gap semiconductor as claimed in claim 1, further comprising:

20 a region having a conductive type identical to that of the second emitter layer and provided in the second base layer in the neighborhood of the end portion of the junction between the second base layer and the second emitter layer.

25 5.(amended) A gate turn-off thyristor of a wide-gap semiconductor, comprising:

a first emitter layer of either one of n-type and p-type conductive types having a first electrode on its one surface;

5 a first base layer of a conductive type different from that of the first emitter layer provided on the other surface of the first emitter layer;

a second base layer of a conductive type identical to that of the first emitter layer provided on the first base layer;

10 a mesa-type second emitter layer of a conductive type different from that of the first emitter layer provided on the second base layer;

a second electrode provided on the mesa-type second emitter layer; and

15 a low-resistance gate region having a conductive type identical to that of the second base layer and provided at a bottom portion of a mesa that includes a neighborhood of a junction between the mesa-type second emitter layer and the second base layer in a neighborhood
20 of a surface of the second base layer, with interposition of a region of a conductive type identical to that of the second emitter layer between the low-resistance gate region and an end portion of the junction.

6. (amended) A gate turn-off thyristor of a wide-gap semiconductor, comprising:

5 a first emitter layer of either one of n-type and p-type conductive types having a first electrode on its one surface;

a first base layer of a conductive type different from that of the first emitter layer provided on the other surface of the first emitter layer;

10 a second base layer of a conductive type identical to that of the first emitter layer provided on the first base layer;

a mesa-type second emitter layer of a conductive type different from that of the first emitter layer provided on the second base layer;

15 a second electrode provided on the mesa-type second emitter layer;

20 a low-resistance region having a conductive type identical to that of the second base layer and provided in a position located apart from the junction between the mesa-type second emitter layer and the second base layer in a neighborhood of a surface of the second base layer;

a third electrode put in contact with the low-resistance region; and

25 a region of a conductive type identical to that of the second emitter layer provided in the second base

layer in the neighborhood of the end portion of the junction between the second base layer and the second emitter layer.

5 7. (amended) A gate turn-off thyristor of a wide-gap semiconductor, comprising:

 a first emitter layer of either one of n-type and p-type conductive types having a first electrode on its one surface;

10 a first base layer of a conductive type different from that of the first emitter layer provided on the other surface of the first emitter layer;

 a second base layer of a conductive type identical to that of the first emitter layer provided on
15 the first base layer;

 a mesa-type second emitter layer of a conductive type different from that of the first emitter layer provided on the second base layer; and

 a second electrode provided on the mesa-type
20 second emitter layer, wherein

 the second base layer is formed into a mesa type, and a low-resistance gate region of a conductive type identical to that of the second base layer is formed in the first base layer so that the region surrounds the mesa-type
25 second base layer.

8.(amended) The gate turn-off thyristor of a wide-gap semiconductor as claimed in claim 7, further comprising:

5 at least one low-resistance small region of a conductive type identical to that of the low-resistance gate region formed inside the low-resistance gate region.

9. The gate turn-off thyristor of a wide-gap semiconductor as claimed in claim 1, wherein

10 the first emitter layer is an n-type cathode emitter layer, the first base layer is a p-type base layer, the second base layer is an n-type base layer, the second emitter layer is a p-type anode emitter layer, and the low-resistance gate region is an n-type, and

15 the first, second and third electrodes are a cathode electrode, an anode electrode and a gate electrode, respectively.

10. The gate turn-off thyristor of a wide-gap semiconductor as claimed in claim 1, wherein

20 the first emitter layer is a p-type anode emitter layer, the first base layer is an n-type base layer, the second base layer is a p-type base layer, the second emitter layer is an n-type cathode emitter layer, and the
25 low-resistance gate region is a p-type, and

the first, second and third electrodes are an anode electrode, a cathode electrode and a gate electrode, respectively.

5 11. The gate turn-off thyristor of a wide-gap semiconductor as claimed in claim 1, wherein

the wide-gap semiconductor is silicon carbide (SiC).

10 12. The gate turn-off thyristor of a wide-gap semiconductor as claimed in claim 1 or 8, wherein

an impurity concentration of the low-resistance gate region is three or more times an impurity concentration of the base region.

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13. A gate turn-off thyristor of a wide-gap semiconductor, comprising:

a first emitter layer of either one of n-type and p-type conductive types having a first electrode on its one surface;

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a first base layer of a conductive type different from that of the first emitter layer provided on the other surface of the first emitter layer;

a second base layer of a conductive type identical to that of the first emitter layer provided on the first base layer;

5 a mesa-type second emitter layer of a conductive type different from that of the first emitter layer provided on the second base layer;

a contact electrode put in contact with the mesa-type second emitter layer in a region excluding a central region of the second emitter layer;

10 a low-resistance region provided so as to surround the mesa-type second emitter layer in a region located apart from an end portion of a junction between the mesa-type second emitter layer and the second base layer, the low-resistance region having a conductive type
15 identical to that of the second base layer and an impurity concentration higher than that of the second base layer; and

a second electrode put in contact with an end portion of the low-resistance region.

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14.(amended) A gate turn-off thyristor of a wide-gap semiconductor, comprising:

a first emitter layer of either one of n-type and p-type conductive types having a first electrode on its one
25 surface;

a first base layer of a conductive type different from that of the first emitter layer provided on the other surface of the first emitter layer;

5 a second base layer of a conductive type identical to that of the first emitter layer provided on the first base layer;

a mesa-type second emitter layer of a conductive type different from that of the first emitter layer provided on the second base layer;

10 a high-resistance region provided in a central region of an upper surface of the second emitter layer and having a conductive type identical to that of the second emitter layer and an impurity concentration lower than that of the second emitter layer;

15 a second electrode put in contact with the second emitter layer and the high-resistance region;

a low-resistance region provided in a region located apart from an end portion of a junction between the mesa-type second emitter layer and the second base layer so
20 that the region surrounds the mesa-type second emitter layer, the low-resistance region having a conductive type identical to that of the second base layer and an impurity concentration higher than an impurity concentration of the second base layer; and

a third electrode put in contact with an end portion of the low-resistance region.

15. (amended) A gate turn-off thyristor of a wide-gap
5 semiconductor, comprising:

a first emitter layer of either one of n-type and p-type conductive types having a first electrode on its one surface;

10 a first base layer of a conductive type different from that of the first emitter layer provided on the other surface of the first emitter layer;

a second base layer of a conductive type identical to that of the first emitter layer provided on the first base layer;

15 a mesa-type second emitter layer of a conductive type different from that of the first emitter layer provided on the second base layer;

20 a region of a conductive type different from that of the second emitter layer provided in a central region of an upper surface of the mesa-type second emitter layer; and

a second electrode located opposite to the second emitter layer and the region via at least a contact electrode.

16.(amended) A gate turn-off thyristor of a wide-gap semiconductor, comprising:

5 a first emitter layer of either one of n-type and p-type conductive types having a first electrode on its one surface;

a first base layer of a conductive type different from that of the first emitter layer provided on the other surface of the first emitter layer;

10 a second base layer of a conductive type identical to that of the first emitter layer provided on the first base layer;

15 a heavily doped region provided in a central region of a surface of the second base layer and having a conductive type identical to that of the second base layer and an impurity concentration higher than that of the second base layer;

20 a mesa-type second emitter layer provided on the second base layer and the heavily doped region and having a conductive type different from that of the first emitter layer; and

a second electrode put in contact with the mesa-type second emitter layer at least via a contact electrode.